

# Strait of Georgia, British Columbia—Nonbreeding Area for Harlequin Ducks that Breed Throughout the Pacific Northwest

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## Abstract

It is very difficult to track individual migratory ducks between breeding and wintering areas. Since 1989 more than 4,000 harlequin ducks have been banded by various researchers in western Canada and the USA, with uniquely coded colour leg bands. Many of these birds have been resighted at breeding streams and wintering areas. We show that the Strait of Georgia, in particular the area on the east side of Vancouver Island from Qualicum Beach to Quadra Island, is an important wintering area for harlequin ducks from breeding streams throughout the Pacific Northwest. Birds that were banded on breeding streams in Alberta, British Columbia, Idaho, Montana, Oregon and Washington have been resighted in the Strait of Georgia, and birds that were banded in the Strait have been resighted inland. These connections have been made possible through the cooperation of many researchers and volunteers.

## Connecting Breeding and Nonbreeding Areas for Migratory Ducks

Harlequin Ducks (*Histrionicus histrionicus*) moult and winter off the west coast of North America, from northern California to the Aleutian Islands in Alaska. Small numbers are seen off the exposed coastlines of Washington and Oregon, with a few as far south as northern California (Robertson and Goudie 1999). Larger numbers are found within the relatively protected waters in Juan de Fuca Strait, Puget Sound (Schirato 1993), Hecate Strait and Strait of Georgia (Campbell et al. 1990; Breault and Savard 1991). In these areas the moulting and wintering ranges overlap. The wintering population in the Strait of Georgia is estimated to be 11,000 to 15,000 birds (Robertson and Goudie 1999).

In the northwestern states, harlequin ducks are known to breed in northwestern Wyoming, western Montana, northern Idaho, the Cascade Mountain range of Oregon, and throughout much of Washington, except dry interior portions. In western Canada breeding records are present for all of southern British Columbia, including Vancouver Island, north to the Queen Charlotte Islands, northwestern coastal areas and the Peace River drainage, and along the entire eastern front of the Rocky Mountains in Alberta, and north through most of the Yukon, except the extreme north and east (Robertson and Goudie 1999).

Most connections between breeding and non-breeding areas for individual migratory ducks have been the result of marking birds with metal leg bands and recovering these bands later, usually from hunters (Owen and Black 1990). For some species, such as those in the tribe Mergini, there are few recoveries because they are less frequently hunted. More recently satellite telemetry has been employed to track movements of some species, such as the spectacled eider (*Somateria fisheri*) and the harlequin duck (Petersen et al. 1995; Brodeur et al. 2002). Auxiliary markers—coloured leg bands, nasal tags, patagial tags, neck collars—to aid in relocating individual birds have been used with varying degrees of success depending on the species (e.g. Barrow's Goldeneye *Bucephala islandica*) (Savard 1985).

Since 1986 (Breault and Savard 1995) researchers have been individually marking harlequin ducks in western Canada and the northwestern U.S.A. Here we report on movements of individual harlequin ducks between breeding areas in the mountains of western Canada and the northwestern states, and nonbreeding coastal areas.

## Methods

The terms “wintering,” “non-breeding” and “post-breeding” are often used interchangeably. If these are considered along with “moulting” and “migrating period,” it is difficult to clearly define them, because they usually overlap at least partially in space and time (Baldassarre and Bolen 1994). We will use the term “nonbreeding” in this discussion to encapsulate all of these periods and areas, and “breeding” for the nesting and brood-rearing periods and areas.

**Breeding captures**—On breeding streams a 12- to 18-metre mist net was set across the stream, and birds were actively moved towards the net (e.g., MacCallum 1997; Smith 2000). Adult males and females were captured in the spring, while females with broods were captured in the late summer.

**Nonbreeding captures**—During the nonbreeding season birds were captured during the wing moult in July, August and September. People in sea kayaks moved flightless individuals into a drive trap placed on an intertidal beach (Clarkson and Goudie 1994). A small number of flying birds were captured in September using a floating mist net modified from Kaiser et al. (1995), set perpendicular to shore, with one end attached to shore (H. Regehr and M. Rodway, pers. comm.).

**Marking birds**—All captured birds were marked with a standard numbered U. S. Fish and Wildlife Service aluminum band on one tarsus. In the early Montana and Alberta studies, combinations of different colour and width bands were placed on the other tarsus (Ashley 1994; Hunt 1998). Since 1994, most researchers have been using a coloured plastic band with a unique two-digit code on the other tarsus. In some studies birds were also marked with nasal tags with unique colour-shape combinations (e.g., Cassirer and Groves 1994; Breault and Savard 1995; Rodway *et al.* 2003). A few individuals also received radio attachments (Cassirer and Groves 1994; Smith 2000).

**Relocation of banded birds**—Individuals were relocated in three different ways: resighting, recapture and radio telemetry. Resightings were made using 20-45X- or 20-60X-zoom spotting scopes to read the band code when birds were hauled out within 150 m of observers. Other individuals were recaptured during banding efforts at either the breeding or wintering areas.

**Database search**—A database of resightings is maintained at the Centre for Wildlife Ecology at Simon Fraser University, Burnaby, British Columbia. Banding, resighting and recapture data is updated as it is made available by researchers and the Canadian Wildlife Service Banding Office.

## Results and discussion

More than 4,000 birds have been individually marked in the study area since 1989. In addition to recaptures (more than 800), there are more than 40,000 resightings in the database, some from the same day. There are 18 recoveries in the database—eight of these birds were shot, and the others were either found dead, died during banding, or the cause of death was unknown.

Birds that breed at sites in Alberta, British Columbia, Idaho, Montana, Oregon, Washington and Wyoming have all been relocated at coastal nonbreeding areas (Figure 1) (Cassirer and Groves 1994; MacCallum 1997; Reichel *et al.* 1997; Wright and Clarkson 1998; Smith 2000). The fidelity of adults to moulting and wintering locations is very high (Wright and Clarkson 1998; Robertson and Cooke 1999), which is shown by the number of resightings of individuals in multiple years in the same location.

The use of coloured leg bands for this species works very well because harlequin ducks frequently haul out on boulders, logs, gravel bars, stream banks, beaches, reefs and floating logs. Additionally, nasal tags work well in the winter months when harlequin ducks feed in the near-shore tidal areas (Vermeer 1983) and spend almost all of the daylight hours feeding, seldom coming to shore to loaf (R. Torres, unpubl. data).

## Conclusions

The Strait of Georgia has high concentrations of harlequin ducks during the non-breeding season, that go there from throughout the breeding range in western Canada and the northwestern States. There are other concentrations on the coast of British Columbia (Breault and Savard 1991), but resighting work has concentrated on the relatively accessible Strait of Georgia, particularly around the time of the herring spawn (Goudie *et al.* 2002).

These relocations of harlequin ducks between breeding and nonbreeding areas shows the benefits of dedicated long-term field programs that maximize the number of marked and resighted birds, and which benefit from the assistance of many volunteers. Without large samples it is difficult to achieve this knowledge.

In the recent past, significant changes have occurred in coastal ecosystems in southwestern British Columbia. Changes have occurred in herring spawn distributions, fish stocks have declined, and urbanization, and potentially degradation, of the coastline is occurring at a fast rate (Glavin 1997). Populations of harlequin ducks in the Strait of Georgia should continue to be monitored closely using mark-resighting to ensure that populations are not declining, and if necessary, measures should be taken to protect the breeding and coastal habitats they need.

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**Figure 1.** Movements of breeding and non-breeding Harlequin Ducks in western Canada and northwestern United States, showing that birds throughout the breeding area winter in the Strait of Georgia, British Columbia. Red triangles (▲) denote breeding area, captures or relocations; green circles (●) denote non-breeding captures or relocations. Black lines connect breeding and non-breeding areas, and do not necessarily reflect migration paths

